

INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference P3118 WO ORD	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/03853	International filing date (day/month/year) 05.09.2003	Priority date (day/month/year) 06.09.2002
International Patent Classification (IPC) or both national classification and IPC B01L3/00		
Applicant EPIGEM LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
 - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application

Date of submission of the demand 15.03.2004	Date of completion of this report 07.01.2005
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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/GB 03/03853**

1. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-21 as originally filed

Claims, Numbers

1-19 received on 06.09.2004 with letter of 03.09.2004

Drawings, Sheets

1/12-12/12 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-19
	No: Claims	
Inventive step (IS)	Yes: Claims	1-19
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-19
	No: Claims	

2. Citations and explanations

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB 03/03853

The application relates to a modular microfluidic system comprising one base board with a plurality of fluidly linked fluid supply apertures and several microfluidic modules adapted to be detachably attached to said base board.

The microfluidic modules have a fluid inlet and/or outlet and the supply aperture on the base board is releasably fluid-tight connected to an inlet/outlet on the microfluidic module through channel means that are insertable into a suitably shaped recess. By means of the claimed microfluidic system problems relating to modularity and variable functionality of microfluidic devices are addressed.

US-A-6331439 discloses a modular microfluidic system made of three modules or layers which can be detachably coupled to each other. A fluid coupling comprising channel means insertable into suitably shaped recesses of one module cannot be seen.

DE-A-19928412 discloses a modular microfluidic system made of a supply element coupled to microfluidic chip. Details about the coupling mechanism are not given and channel means insertable into a suitably shaped recess are not disclosed. Further the supply element does not have a plurality of fluidly linked fluid supply apertures as in the present application.

Hence claims 1-19 cannot be rendered obvious by the documents cited in the search report and they meet the requirements of Art. 33 PCT.

CLAIMS

1. A modular microfluidic system comprising at least one base board having a plurality of fluidly linked fluid supply apertures on one or both sides thereof, a plurality of microfluidic modules adapted to be detachably attached to the base board, each having one or more fluid inlets and/or outlets, and a plurality of fluid couplings to effect releasable fluid-tight connection between a module and a base board via a supply aperture on the base board and an inlet/outlet on the microfluidic module, a fluid coupling comprising a channel means insertable into a suitably shaped recess in such an inlet/outlet/aperture to effect a fluid light communication therebetween.
2. A modular microfluidic system in accordance with claim 1 wherein the channel means comprises a rigid tubular element, with any recess into which such a tubular element is to be received being shaped accordingly.
3. A modular microfluidic system in accordance with claim 2 wherein the tubular element comprises a projecting ferrule integral with and projecting from a first aperture comprising either a fluid supply aperture in the base board or an inlet/outlet in the module, and adapted to be received in a recess comprised as a second aperture, correspondingly either an inlet/outlet in the module or a supply aperture in the base board.
4. A modular microfluidic system in accordance with any preceding claim wherein the ferrule projects generally perpendicularly from a generally planar surface of the base board, to effect a fluid connection between a base board and module adapted to lie generally parallel when connected.

5. A modular microfluidic system in accordance with any preceding claim wherein the channel means have a circular or elliptical cross section.
- 5 6. A modular microfluidic system in accordance with any preceding claim further comprising at least one fluid source aperture fluidly linked thereto to supply source fluid to the system, and/or at least one fluid output aperture fluidly linked thereto to output fluid from the system.
- 10 7. A modular microfluidic system in accordance with any preceding claim wherein the base board is constructed with a pattern of interconnecting microfluidic channels to provide a plurality of fluid channels and/or chambers in use linking in fluid communication at least some of the supply apertures to each other and/or to the source aperture.
- 15 8. A modular microfluidic system in accordance with any preceding claim wherein each microfluidic module comprises one or more microfluidic devices.
- 20 9. A modular microfluidic system in accordance with claim 8 wherein the microfluidic devices include devices selected from the list comprising a reactor, heater, cooler, analyser, detector, mixer, processor, separator or the like, a pump, valve, filter or the like, or a fluid channel, chamber or manifold.
- 25 10. A modular microfluidic system in accordance with any preceding claim wherein each module has a generally planar construction to be incorporated upon a generally planar baseboard.

11. A modular microfluidic system in accordance with any preceding claim wherein different parts of boards and/or modules are fabricated from different materials to provide different functional requirements regarding transparency, structural strength, chemical resistance and the like.
- 5
12. A modular microfluidic system in accordance with claim 11 wherein a board and/or module comprises a composite structure having areas of a transparent material where required, and areas of a chemically resistant material at least in regions where solvent contact is possible, preventing
- 10 contact with the less resistant transparent substrate material.
13. A modular microfluidic system in accordance with any preceding claim wherein connecting means are provided to hold the assembly together in use and assist in maintenance of a fluid-tight connection by urging
- 15 coupling and aperture into closer association and retaining thereat with a suitable urging force.
14. A modular microfluidic system in accordance with any preceding claims wherein the removably insertable tubular channel means incorporates or
- 20 is provided with a closure for closing a pathway not being used in a particular device combination.
15. A modular microfluidic system in accordance with any preceding claim wherein the tubular channel means includes within a fluid channel
- 25 therewithin a fluidly active component
16. A modular microfluidic system in accordance with any preceding claim wherein the tubular fluid coupling is metallic tubular channel coupling

such as a metallic ferrule to effect an electrical as well as a fluid interconnection.

17. A modular microfluidic system in accordance with any preceding claim,
5 comprising a plurality of modules, a base board and one or more intermediate level board constructed in like manner to the base board, the assembly being adapted for multi-level stacking of modules and/or base boards and/or intermediate level boards.
- 10 18. A modular microfluidic system in accordance with claim 17 wherein channel means comprising rigid tubular ferrules are provided at apertures in the upper surface of the base board and at apertures in the upper surface of all intermediate level modules, to be receivingly engaged in
15 fluid tight connection within recessed portions at apertures on the lower surface of all intermediate level components and all top level components.
19. A method of providing a microfluidic system as a modular assembly comprising the steps of:
20 providing at least one base board having a plurality of fluidly linked fluid supply apertures on one or both sides thereof and a plurality of fluid channels and/or chambers linking in fluid communication at least some of the supply apertures;
providing a plurality of microfluidic modules, each having one or more
25 fluid inlets and/or outlets and at least one fluid channel or chamber in fluid communication therebetween;
a fluid coupling comprising a channel means insertable into a suitably shaped recess in such an inlet/outlet/aperture to effect a fluid tight communication therebetween.

connecting the modules to the base board via the fluid couplings to effect releasable fluid-tight connection therebetween via a supply aperture on the base board and an inlet/outlet on the module;

5 such that the fluid channels or chambers within the modules act in co-operation with fluid channels or chambers in the baseboard to complete a desired microfluidic circuit.

CLAIMS

1. A modular microfluidic system comprising at least one base board having a plurality of fluidly linked fluid supply apertures on one or both sides thereof, a plurality of microfluidic modules adapted to be detachably attached to the base board, each having one or more fluid inlets and/or outlets, and a plurality of fluid couplings to effect releasable fluid-tight connection between a module and a base board via a supply aperture on the base board and an inlet/outlet on the module.
2. A modular microfluidic system in accordance with claim 1 further comprising at least one fluid source aperture fluidly linked thereto to supply source fluid to the system, and/or at least one fluid output aperture fluidly linked thereto to output fluid from the system.
3. A modular microfluidic system in accordance with claim 1 or claim 2 wherein the base board is constructed with a pattern of interconnecting microfluidic channels to provide a plurality of fluid channels and/or chambers in use linking in fluid communication at least some of the supply apertures to each other and/or to the source aperture.
4. A modular microfluidic system in accordance with any preceding claim wherein each microfluidic module comprises one or more microfluidic devices.
5. A modular microfluidic system in accordance with claim 4 wherein the microfluidic devices include devices selected from the list comprising a reactor, heater, cooler, analyser, detector, mixer, processor, separator or

the like, a pump, valve, filter or the like, or a fluid channel, chamber or manifold.

- 5 6. A modular microfluidic system in accordance with any preceding claim wherein each module has a generally planar construction to be incorporated upon a generally planar baseboard.
- 10 7. A modular microfluidic system in accordance with any preceding claim wherein different parts of boards and/or modules are fabricated from different materials to provide different functional requirements regarding transparency, structural strength, chemical resistance and the like.
- 15 8. A modular microfluidic system in accordance with claim 7 wherein a board and/or module comprises a composite structure having areas of a transparent material where required, and areas of a chemically resistant material at least in regions where solvent contact is possible, preventing contact with the less resistant transparent substrate material.
- 20 9. A modular microfluidic system in accordance with any preceding claim wherein connecting means are provided to hold the assembly together in use and assist in maintenance of a fluid-tight connection by urging coupling and aperture into closer association and retaining thereat with a suitable urging force.
- 25 10. A modular microfluidic system in accordance with any preceding claim wherein a plurality of releasable fluid couplings are provided to effect a fluid-tight connection between at least one fluid supply aperture on a base board and at least one inlet/outlet on a microfluidic device module.

11. A modular microfluidic system in accordance with claim 10 wherein the releasable coupling is in the form of a channel means removably insertable into a suitable recess in such a inlet/outlet/aperture to effect a fluid tight communicating connection therebetween.
- 5
12. A modular microfluidic system in accordance with claim 11 wherein the channel means comprises a rigid tubular element, with any recess into which such a tubular element is to be received being shaped accordingly.
- 10
13. A modular microfluidic system in accordance with claim 12 wherein the tubular element comprises a projecting ferrule integral with and projecting from a first aperture comprising either a fluid supply aperture in the base board or an inlet/outlet in the module, and adapted to be received in a recess comprised as a second aperture, correspondingly
- 15
- either an inlet/outlet in the module or a supply aperture in the base board.
14. A modular microfluidic system in accordance with claim 13 wherein the ferrule projects generally perpendicularly from a generally planar surface of the base board, to effect a fluid connection between a base board and
- 20
- module adapted to lie generally parallel when connected.
15. A modular microfluidic system in accordance with one of claims 10 to 14 wherein the removably insertable channel means incorporates or is provided with a closure for closing a pathway not being used in a
- 25
- particular device combination.
16. A modular microfluidic system in accordance with any preceding claim wherein the fluid coupling includes within a fluid channel therewithin a fluidly active component

17. A modular microfluidic system in accordance with any preceding claim wherein the fluid coupling is metallic fluid coupling such as a metallic ferrule to effect an electrical as well as a fluid interconnection.
- 5
18. A modular microfluidic system in accordance with any preceding claim, comprising a plurality of modules, a base board and one or more intermediate level board constructed in like manner to the base board, the assembly being adapted for multi-level stacking of modules and/or base
- 10 boards and/or intermediate level boards.
19. A modular microfluidic system in accordance with claim 18 wherein channel means comprising rigid tubular ferrules are provided at apertures in the upper surface of the base board and at apertures in the upper
- 15 surface of all intermediate level modules, to be receivingly engaged in fluid tight connection within recessed portions at apertures on the lower surface of all intermediate level components and all top level components.
- 20
20. A method of providing a microfluidic system as a modular assembly comprising the steps of:
- providing at least one base board having a plurality of fluidly linked fluid supply apertures on one or both sides thereof and a plurality of fluid channels and/or chambers linking in fluid communication at least some
- 25 of the supply apertures;
- providing a plurality of microfluidic modules, each having one or more fluid inlets and/or outlets and at least one fluid channel or chamber in fluid communication therebetween;

connecting the modules to the base board via fluid couplings adapted to effect releasable fluid-tight connection therebetween via a supply aperture on the base board and an inlet/outlet on the module;
such that the fluid channels or chambers within the modules act in co-
5 operation with fluid channels or chambers in the baseboard to complete a desired microfluidic circuit.